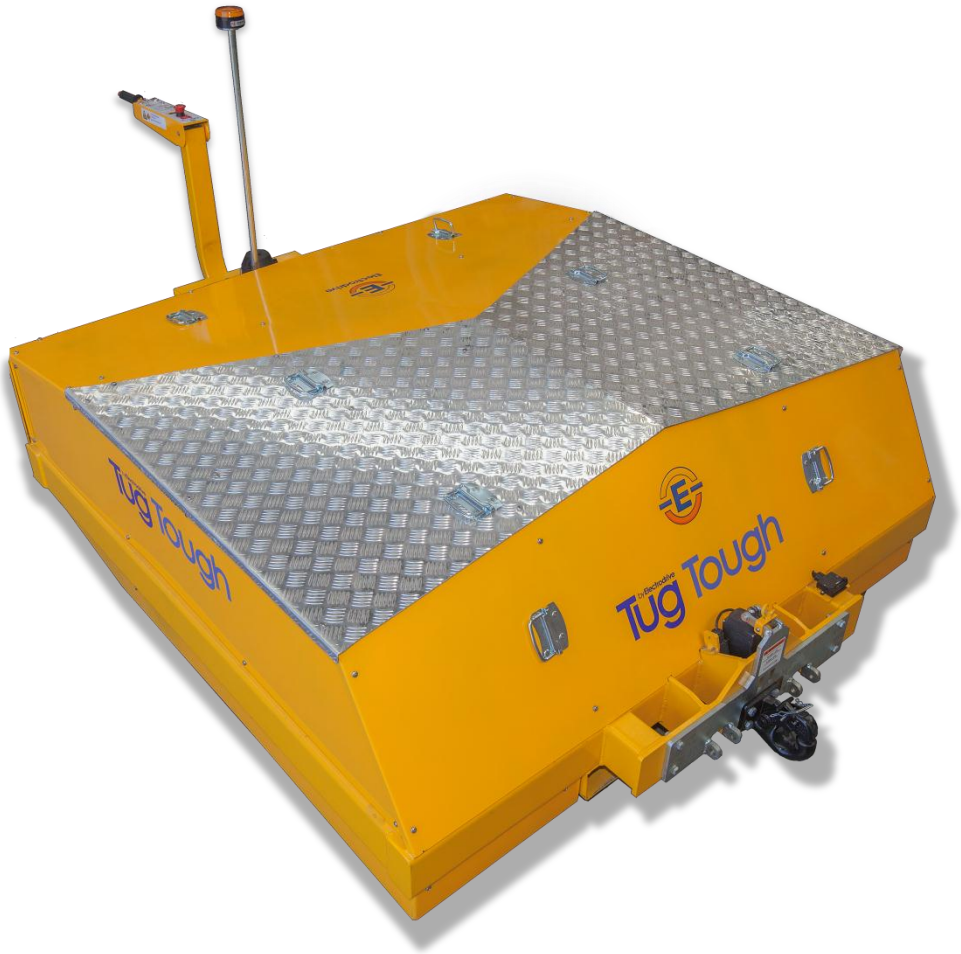
Operation Manual
Tug Tough 20T



Contents

General Information

Introduction

This service manual covers Electrodrive Tug Tough 20T tug machine.

Description

Electrodrive Tug Tough 20T is a battery powered industrial truck for towing trolleys with very heavy loads. Typical applications include heavy vehicle maintenance i.e. moving truck and mining engines, pulling buses and trucks, aerospace maintenance i.e. moving aeroplanes in and out of hangars. The tug machine comes with slots to hook up any custom hitch for any towing use.

The Tug Tough 20T is a 48 Volt dc powered machine with high torque motors and advanced gearing system. It is encased in a robust chassis with heavy duty wheels.

Other features include:

- Variable speed drive unit
- Travel speed – up to 2.00 kph
- Tiller handle steering that folds up to reduce space when not in use
- Motor controller
- Automatic charger
- Emergency stop button switch

Specifications:

- Charging Voltage: 220 – 240 V ac
- Operating Voltages: 48 V dc (motor) & 24 V dc (control circuit)
- Maximum Speed: 2.0 kph
- Approx. Gross Weight (No Hitch): 3,000 kg
- Maximum Towing Capacity: 20 tonnes (measured on level surface)

Figure 1-1 – Outline Diagram of 20T Tug Tough Machine

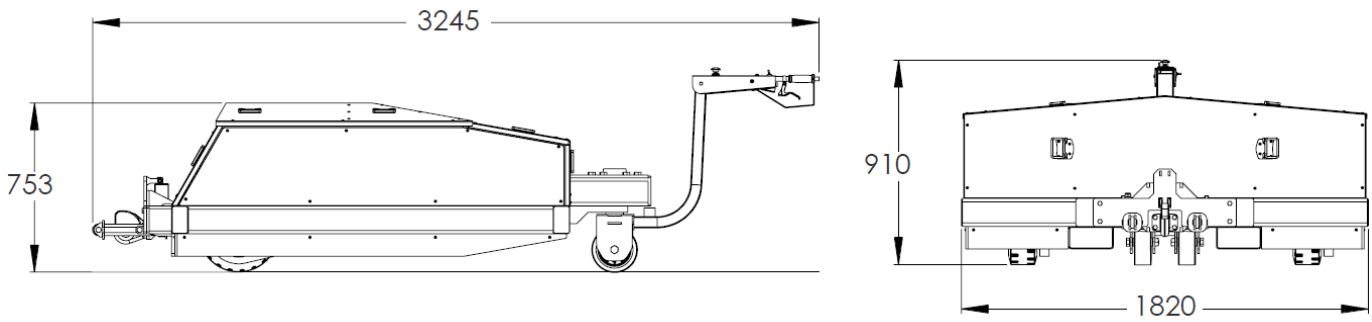


Figure 1-2 – Main Parts of 20T Tug Tough Machine

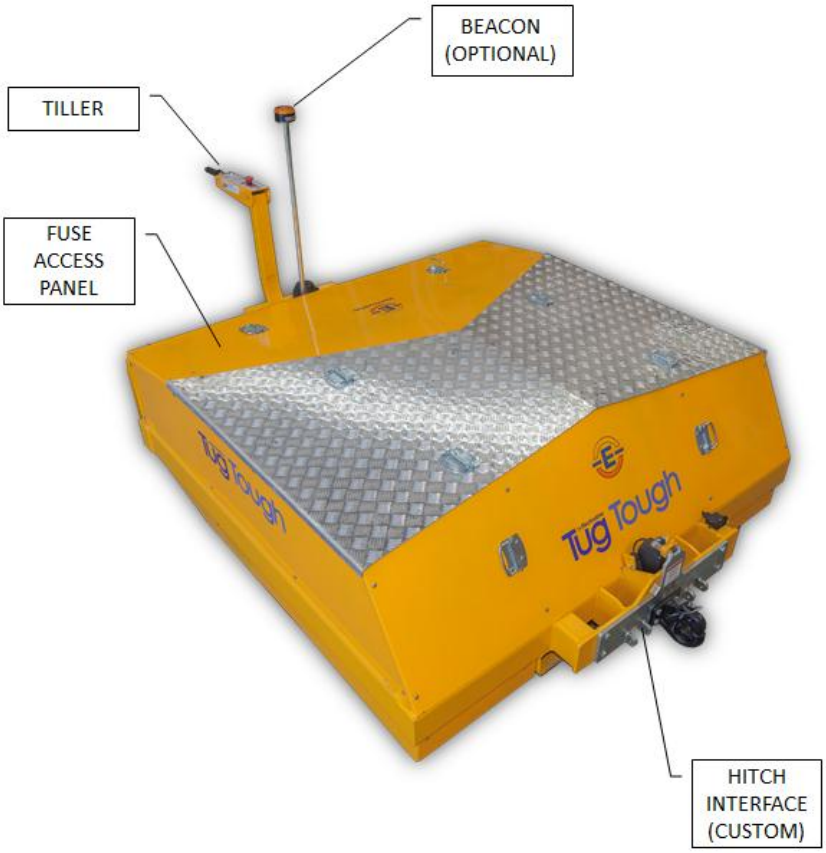


Figure 1-3 – 20T Tug Tough Machine Tiller Console

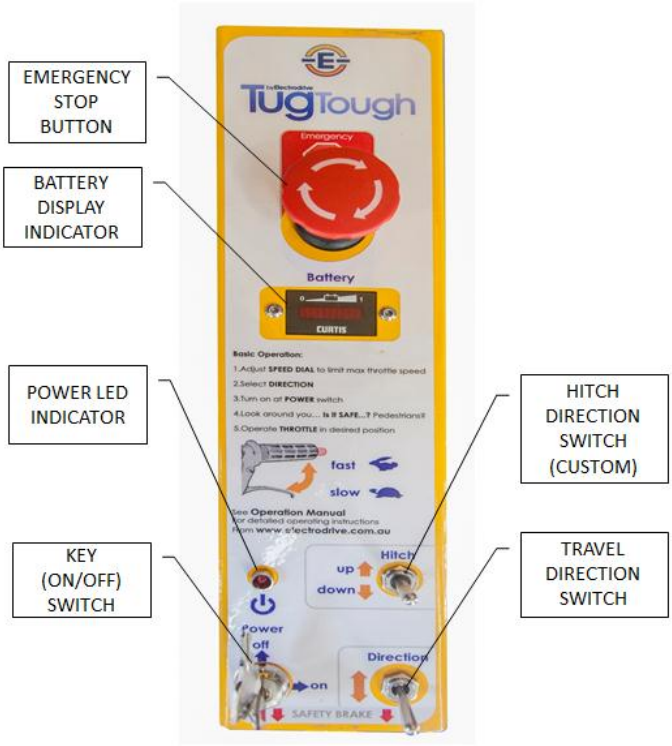


Figure 1-4 - Battery Charger with Lead

Graphical symbols definition used in this manual

✓ The tick mark symbol represents any operation information that may help the user in operating and maintaining this machine.

 The exclamation point within a triangle symbol is intended to alert the user of the machine of the presence of important operating and maintenance instructions.

 The lightning within a triangle symbol is intended to alert the user presence of uninsulated voltages encapsulated within the machine that may be of sufficient magnitude to constitute a risk of electrocution to the users.

Principles of Operation

Key (On / Off) switch

Situated on the tiller, the key switch must be turned clockwise to switch the Tug Tough 20T tug machine 'on'. When the tug is 'on' the power light will illuminate.

- ✓ The tug should be turned off whenever it is not in use.

Travel direction toggle switch

The direction toggle switch is located on the tiller. Toggle the switch between forward and reverse for travel direction.

- ✓ For safety and to prevent shunting, toggling between forward and reverse with throttle applied will stop the tug.
- ✓ To reset tug control, release the throttle, select the opposite direction then apply minimum throttle. Return throttle to neutral and select desired direction.

Optional hitch:
A range of customised hitches can be fitted to the 20T Tug. (*See the Operation Manual of the hitch for attachment and operation instructions.)*

Hitch operation (Indicative Only):

The hitch direction switch is located on the tiller. Toggle the switch to engaged hitch hook onto the hook bin.

Steering lock toggle switch *(Refer to Operating Manual 20T Tug Hook Bin Hitch for full instruction.)*

The 20T Tug Tough is manufactured with steering lock used for steering the hook bin hitch attachment. The steering lock allows ease in manoeuvring of the tug whilst the hook bin hitch is attached.

Steering lock status indicator

The tug is equipped with LED lamps to indicate if the steering lock is in operation. When the Raising and Lowering LED lamps are not lit whilst toggling, it indicates that the steering lock is in the end position.

Safety brake

The RED button on the end of the tiller handle acts as an emergency facility. The unit will stop automatically when this RED button is engaged to prevent the operator from getting caught between an immovable object or in a confined space. To reset, select forward direction and apply minimum throttle.

Emergency stop button

These are emergency facilities only and are not to be used in conjunction with normal operation.

The RED button on the top of the tiller console is an emergency stop button. In an emergency push this button to STOP the tug. To release, slightly twist the button and it will "pop" back up.

Throttle lever

The throttle lever is controlled by hand and provides variable speed control from zero up to 2.00 kph (unless specified otherwise). Releasing the lever stops the unit.

Speed governor dial

The dial is located on the end of the tiller handle allows the operator to restrict the maximum speed. Turn the dial clockwise for higher speed and anti-clock wise for slower speed.

It is advised that the operator uses a lower speed when learning to operate Tug Tough 20T machine.

Battery level indicator

The illumination on the battery gauge located on the tiller indicates the amount of power left in the batteries. The battery level is indicated by a line. Nominal battery voltage is 48 Vdc (54 Vdc max, 36 Vdc min).

Indication significance

- ✓ Second to last bar illumination is flashing – this indicates that the battery voltage is approaching minimum voltage for the tug to operate and must be recharged immediately.
- ✓ Last and second to last bar illuminations flashing alternately – this indicates that the batteries have reached maximum discharge and the tug must not be used.

⚠ Operating the tug when the last and second to last bar illuminations are flashing alternately will cause damage to batteries and reduced battery life.

Horn

The 20T Tug Tough horn is a yellow push button located at the end of the tiller. Push and hold to sound the horn, release to turn off.

Charger socket

The plug on the charger is fitted into the charger socket mounted on the chassis of the Tug Tough 20T machine, next to the tiller post.

- ✓ The 48 V battery isolator switch must be in the "ON" position for charging to commence.

⚠ The tug will not operate when the machine is plugged into the charger.

⚠ Whilst charging do **NOT** expose the battery charger in the rain.

Brakes

No park brake is fitted on the machine. The tug relies on 56:1 gearbox ratio to stop the tug when the throttle is released and the tug motors are de-energised. Load braking shall be supplied the supplier.

To avoid overloading, ensure that braking castors of trolleys or mobile equipment being pulled are disengaged prior to operating the tug.

48 V dc and 24 V dc battery isolators

The Tug Tough 20T machine is fitted with 4 – 150 Ah 12 V batteries; this isolator isolates the batteries from the machine for safety when not in use. It is also fitted with 24 V dc circuit controllers; this isolator isolates the batteries from the circuit controllers for safety.

Operating Instructions

Safety Check

Before using the Tug Tough 20T machine the operator should complete the following check:

- ✓ The battery charger is not connected (will not move if charger is plugged into machine)
- ✓ The Forward and Reverse control switch works
- ✓ The Emergency button works
- ✓ Both main and secondary battery isolator keys are in the closed position
- ✓ The battery indicator shows adequate charge i.e. Indicator is showing "1"
- ✓ There are no signs of visible damage to the unit

Hitching to a trolley

The Tug Tough 20T machine is equipped with mounting holes that can accommodate a variety of customised hitches.

In all cases, ensure that the trolley being attached to has its brakes engaged (or chocked) and is free from obstruction. Inspect the trolley and ensure that the

trolley castors are in good condition. Towing a trolley in poor condition can overload the tug, and can cause damage not covered under warranty.

Steering

The tiller arm provides easy steering. The Tug Tough 20T machine with the attached trolley can be manoeuvred through relatively tight areas.

 It is **STRONGLY RECOMMENDED** that the operator lead the Tug Tough 20T machine and trolley, rather than try to have the unit "push" the trolley. This will ensure that the operator has unobstructed forward vision, and in addition both the tug and trolley are easier to steer.

Unhitching

Always make sure the trolley is on a flat level surface.

 Apply the brakes (if fitted) or chock the wheels of the trolley before releasing from the tug.

Battery charging

- ✓ Always charge batteries once the job is done or day's use is complete.
- ✓ Always leave batteries on charge until the charge is COMPLETE.
- ✓ Opportunity charging is NOT recommended. This can also shorten battery life.
- ✓ Never leave batteries in a discharged state as this will shorten the batteries life.
- ✓ For maximum battery life, a battery must be recharged to 100% capacity. Recharging less than 100% may result in premature battery failure. Batteries are not covered under warranty if they are not recharged properly.
- ✓ Ensure you have the correct charger for the batteries. The correct voltage and current is important to ensure the full life of the batteries.
- ✓ Check all connections are tight and in good condition.
- ✓ Ensure there is enough airflow to help keep the batteries as cool as possible.
- ✓ If batteries are not used for lengthy periods of time, it is recommended to give them a maintenance charge once every 2 months if disconnected from machine.
- ✓ Check the charger lights come on when connected to the batteries. This will indicate the charger is working and ensure the batteries are charging.
- ✓ If charger lights do not come on, call your service technician.
- ✓ If the batteries are swollen turn off immediately and call your service technician.

 The battery charger supplied with the Tug Tough 20T machine must be used. This charger will ensure that the batteries receive charge at the appropriate rate

and will not be overcharged. The automatic features on the charger together with the fact that the standard batteries are sealed gel batteries ensures that there is a minimum amount of gas, if any at all, expelled from the batteries during charging.

Refer to Figure 1-3 for the Battery Charger

 Ensure regular recharging of batteries (charging overnight after a day's usage is recommended). Irregular charging may cause the batteries to prematurely fail. Leaving a machine in storage without charge for periods greater than a month can lead to premature battery failure. This is not covered under warranty.

Maintenance

Batteries
Ensure regular recharging of batteries. The batteries installed are SEALED, and are maintenance FREE.

 Do **NOT** try to open these batteries.

Tyres
The tyres are press on bands – similar to those used on forklift and other material handling equipment. They are puncture resistant.

- ✓ For replacement of tyres, please contact Electrodrive Pty Ltd.

Transmission
Every 3 months check that chain tension has no more than plus or minus 10 mm deflection. The chain requires only very light lubrication at 3 month intervals.

- ✓ The gear boxes are sealed and do not require service.

Motor
Motor brushes should be inspected every six months and replaced every 2 years.

- ✓ Remove the brush retaining cover for access to the brushes, should they need replacing.

Motor controller
This unit is not serviceable by the customer. Any difficulties experienced with speed control should be referred to Electrodrive Pty Ltd.

Throttle lever
The lever and cable do not require maintenance. Should the lever or cable suffer damage they should be replaced. If the handle loosens with wear, the hinge nut can be gently tightened. However, first confirm that the lever is in the correct position as it may need to be re-set.

- ✓ Test by squeezing the lever slightly - the TUG should slowly move, release and the TUG should completely stop.

Fuses

The control circuit is protected against inadvertent current over-loads. These are located adjacent to the controller under the top cover.

Power Circuit Fuse

The tug is fitted with a 200 A fork lift type fuse in the battery supply circuit. Failure of this fuse indicates the tug has sustained overload or an internal malfunction that requires immediate service. If the Power Circuit Fuse has tripped, contact Electrodrive Pty. Ltd. for machine service.

General

Any damage audible or visible to the 20 Tonne Tug Tough Machine should be addressed at the time of discovery. Electrodrive Pty. Ltd. can provide parts and service support on request. Ph: 1800 333 002 Fax: 1800 031 057

Warranty

Electrodrive Pty. Ltd. warrants that the 20 Tonne Tug Tough Machine is free from defects in materials and workmanship for a period of twelve months from the date of dispatch from the Electrodrive plant at 10 Burwood Ave, Sunshine North, Victoria.

If a defect is reported, Electrodrive will repair or replace the defective part, at its own discretion. This warranty does not apply if the 20 Tonne Tug Tough Machine has been misused, damaged, or modified in any way.
Please be aware that modifications and misuse will void your warranty. The following activities (including, but not limited to) are examples of these:

Maintenance

The machine is re-wired by an unauthorized service agent
The motor controller is re-programmed by an unauthorized service agent
There are modifications done to the body or frame of the machine
Use of non-specified parts (Electrodrive genuine parts)
The machine is serviced by an unauthorized service agent

Misuse

Shunting loads at speeds in excess of 2.0kph (specific to 20 tonne machine)
Overloading the unit either during towing or lifting
Carrying people or other foreign objects
Exposed to rain or other precipitation, unless weatherproof option installed
Using the emergency back-off system to change direction regularly
Exposed to a corrosive environment
Driven off road – potholes, gravel, etc
Driven on slopes with a steeper gradient than 1:12 that are not approved by Electrodrive
Not being charged adequately
Using E-stop as an ON/OFF button

General wear items not covered under warranty

- Wheels
- Hand grips
- Motor brushes
- Castors

If you are interested in extending your warranty period through a regular service program, please contact Electrodrive on 1800 333 002. Note: batteries and chargers not included.

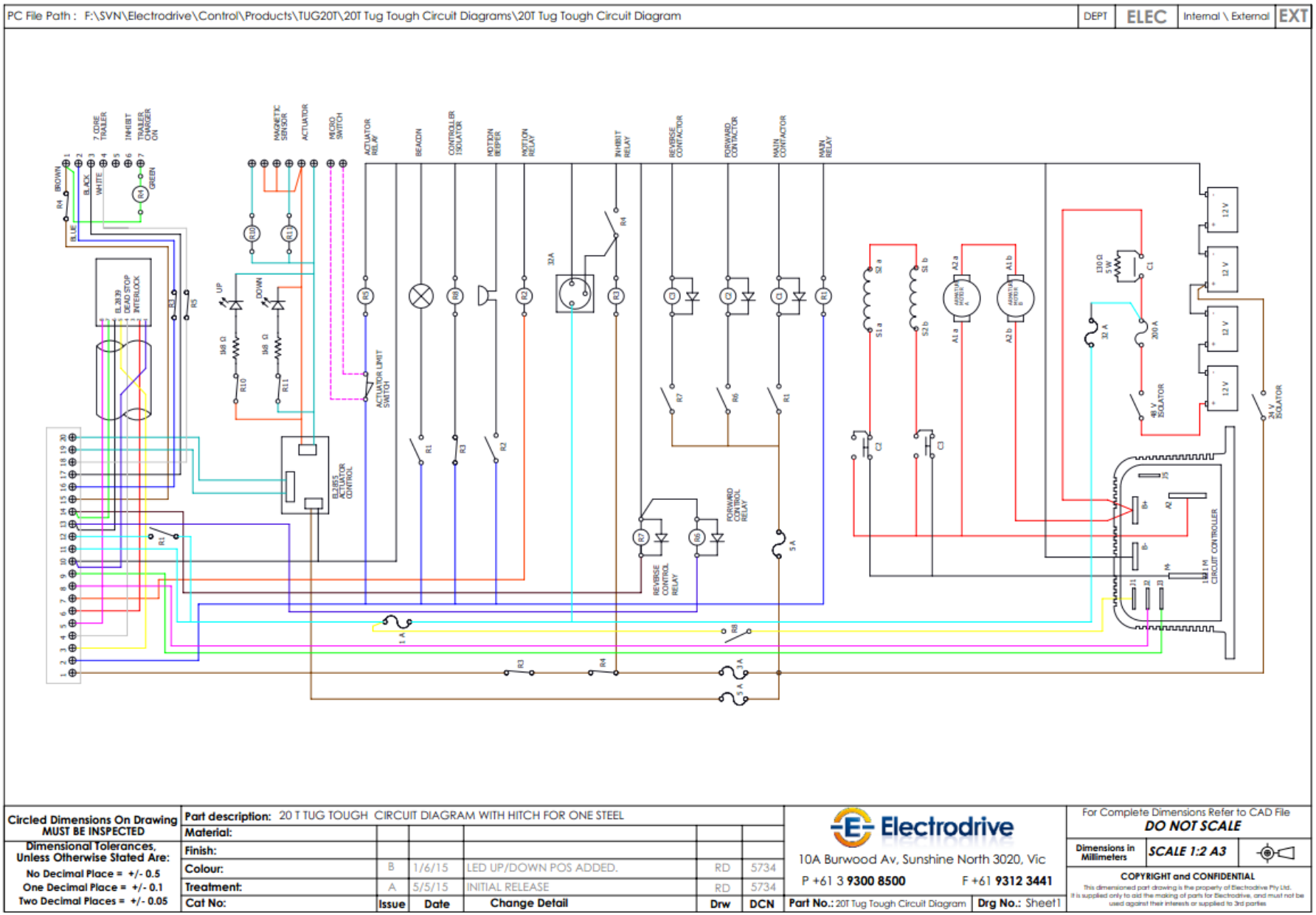
Spare parts list

Component	Item Description
EDMOT20TGEARBOX	20T TUG GEAR BOX
EDMOT20TTRACMTR	20T TUG ADVANCED TRACTION MOTOR
EDSPRTUG20T00920	20T TUG 12B DUPLEX SPROCKET
EDPIN20TGBSHAFT	20T TUG GEAR BOX SHAFT
EDMCHTUG20T00352	20T TUG GEAR BOX SHIM PLATE
EDBAT20T12V150AH	20T TUG 12V 150Ah BATTERY
EDSTBTUG20T00001	20T TUG STUB ASSEMBLY
EDSHFTUG20T00354	20T TUG DRIVE SHAFT
EDTYRTUG20T009	20T TUG PRESS ON TYRE
EDSPRTUG20T00930	20T TUG 12B DUPLEX SPROCKET
EDCHNTUG20T00001	20T TUG DUPLEX CHAIN
EDMCHTUG20T00605	20T TUG LOCKING ARM PIVOT PIN
EDMCHTUG20T00604	20T TUG BEARING PIN
EDMCHTUG20T00606	20T TUG ACTUATOR PIVOT PIN
MOT20TCONTROLLER	20T TUG MOTOR CONTROLLER
RELCONT24VONOFF	Contactor On Off 24V
RELCONT24VCHGOV	Contactor Changeover 24V
EDEL3122	Relays 24V for actuator hitch
EDEL3100	Relay 24volt for 48v system
EDEL2630	Horn Buzzer
EDPLGCHGSCK32A	CHARGER SOCKET 32Amp
EDPLGCHG32A	CHARGER PLUG TOP 32Amp
EDEL2515	Fuse Holder - Maxi Blade fuse
EDEL2516	Fuse holder - Fuse cover to su
EDFUSMAXIB30A	Fuse Maxi Blade - 30Amp
EDEL2492	Fuse 200A forklift
EDEL2500	Fuse Holder Panel Mount
EDEL2470	Fuse 10 Amp (3AG)
EDEL2450	Fuse 1 Amp (3AG)
EDEL2464	Fuse 3 Amp (3AG)
EDEL2466	Fuse 5 Amp (3AG)
EDEL2495	Fuse Base fixing with Nut Suit
EDEL3320	Toggle Switch momentary (up/down)
EDEL2839	PCB - Dead stop interlock
EDEL2855	PCB - Actuator
EDEL2320	DIN Rail Part KST8 Stud termin
EDEL2310	DIN Rail Part KST6 Stud termin
EDEL1960	Connector,terminal,DIN rail,st
EDEL2300	DIN cover plate 2.5 TT Elec Pa

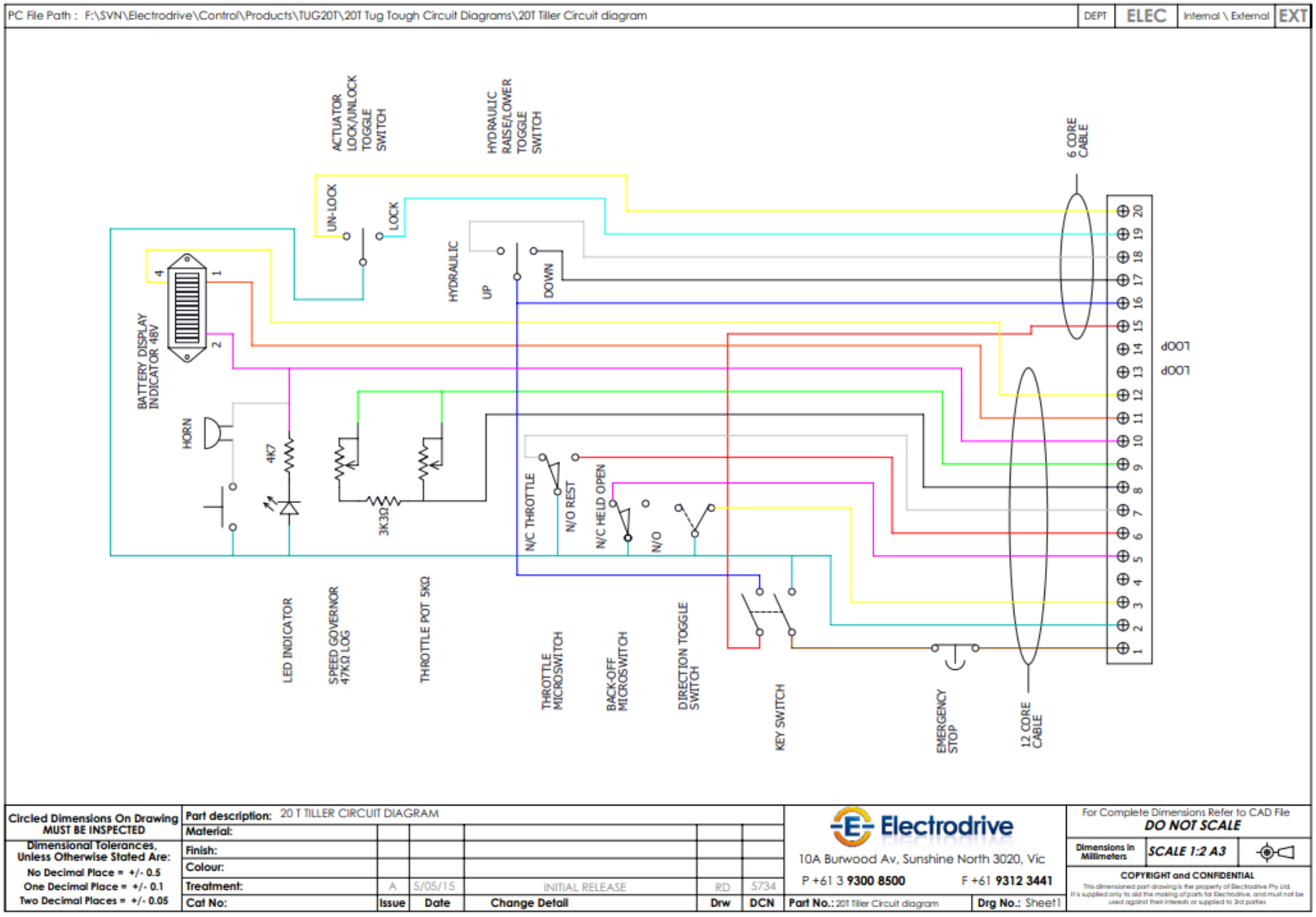
EDEL1950	Connector,terminal,DIN rail,en
EDEL2305	Din Rail G-Type
EDEL1965	Connector DIN Rail Jumper Assy
EDWP1135	Tiller arm - Yellow To suit TugTough
EDEL1775	Cable - trailer flex 7 core
EDPLG7PINFLAT	FLAT TRAILER PLUG 7 PIN
EDPLG7SOCKETFLAT	FLAT TRAILER SOCKET 7 PIN
EDSTK20TBATISO	Sticker 20T Battery Isolator
EDSTK20TCHARSOCK	Sticker 20T Charger Socket
EDSTK20THORN	Sticker 20T Horn
EDSTK20TSAFETYBRE	Sticker 20T Safety Break
EDSTK20TSPEEDDIAL	Sticker 20T Speed Dial
EDSTK20TTILLER	Sticker TugTough-20T
EDLMSIPANEL	LOGO SIDE PANEL
EDEL4203	Emergency Reverse Proximity
EDEL2740	LED Indicator 5mm Red
EDEL2735	LED Indicator 5mm Green
EDEL2696	Isolating Switch H/D
EDMCHMOT20TKEY	20T Tug motor key

**Optional extra. Only applies if fitted.*

20T Tug Tough Circuit diagram



20T Tug Tough Tiller Circuit diagram (6 core cable to hitch indicative only)



Service log

Service recommendations (6 month to 5 year service)

To ensure your 20 Tonne Tug Tough Machine is kept in a safe and reliable condition, it is important to maintain a preventative maintenance program. Maintain a log of the service work on the cards following, and always use an Approved Electrodrive Service Agent to conduct the works.

6 month service			
Date of service		Service agent	
Machine serial number			
Summary of works			
Next service due:			

12 month service			
Date of service		Service agent	
Machine serial number			
Summary of works			
Next service due:			

18 month service			
Date of service		Service agent	
Machine serial number			
Summary of works			
Next service due:			

2 year service			
Date of service		Service agent	
Machine serial number			
Summary of works			
Next service due:			

2 ½ year service			
Date of service		Service agent	
Machine serial number			
Summary of works			
Next service due:			

3 year service			
Date of service		Service agent	
Machine serial number			
Summary of works			
Next service due:			

3 ½ year service			
Date of service		Service agent	
Machine serial number			
Summary of works			
Next service due:			

4 year service			
Date of service		Service agent	
Machine serial number			
Summary of works			
Next service due:			

4 ½ year service			
Date of service		Service agent	
Machine serial number			
Summary of works			
Next service due:			

5 year service			
Date of service		Service agent	
Machine serial number			
Summary of works			
Next service due:			